

UNITED STATES PATENT APPLICATION FOR:

**A DEVICE AND A METHOD FOR DISCONNECTING A TOOL FROM A PIPE
STRING**

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A DEVICE AND A METHOD FOR DISCONNECTING A TOOL FROM A PIPE STRING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit of Norwegian patent application serial number NO 20031305, filed March 21, 2003, which is herein incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention concerns a device and a method to enable disconnection of a tool and a pipe string. More particularly, it concerns a disconnection device to be used especially in connection with coiled tubing operations, in which the connection part attached to the pipe string is of an external transverse dimension that may be equal or smaller than that of the pipe string. The invention also comprises a method of effecting the disconnection.

[0003] During coiled tubing operations, and especially when using a coiled tubing in for example a borehole, a tool attached to the pipe string may become solidly stuck in the borehole to a degree rendering the pipe string useless for pulling it loose.

[0004] Pipe strings are commonly provided with a disconnection device enabling disconnection of the tool and the pipe string, after which the pipe string and the disconnected part of the tool may be retrieved from the borehole. The tool may subsequently be pulled up using fishing tools.

[0005] Known disconnection devices are generally formed with a transverse dimensions larger than that of the pipe strings onto which they are attached. Due to this situation, there can be a problem pulling the part of the connection device connected to the pipe string through restrictions located close to the surface. In the past, this problem as been solved for instance through the use of an explosive

charge that is introduced into the pipe string immediately above the connection, after which the connection device part is disengaged through blasting from the pipe string. The pipe string then may be pulled up to the surface.

[0006] Prior to the positioning of the charge, any hydraulic lines and cables present in the pipe string have to be disconnected and retracted to the surface.

Description of the Related Art

[0007] The object of the invention is to remedy the disadvantages associated with the prior art.

[0008] The object of the invention is achieved through features disclosed in the specification below and in the subsequent claims.

[0009] In accordance with one aspect of the present invention there is provided a disconnection device for disconnecting a tool and a pipe string, the device comprising a first connection part releasably connected to a second connection part by means of a locking device and a release object, wherein at least a section of the release object is soluble.

[0010] At least in preferred embodiments, a first connection part having an outer transverse dimension equal to or less than that of the pipe string is connected, possible via intermediate parts, to the lower end section of the pipe string. By means of an axially split connector ring of known type, the first connection part is releasably connected to a second connection part. The second connection part is connected, possible via intermediate parts, to a tool.

[0011] The split connector ring is maintained in its locking position by means of a pre-stressed locking object aimed in the direction of opening, a release object preventing the locking object from shifting away from its locking position.

[0012] The release object is formed of a material that is soluble by means of, for example, an acid, a base or a solvent.

[0013] During pipe string operations of the stated type, at least one hydraulic pipe is commonly introduced down to the tool inside the pipe string. By connecting this hydraulic pipe to the release object, the object may be dissolved for instance upon pumping acid down through the hydraulic pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] A preferred embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

[0015] Fig. 1 shows a connector placed between a pipe string and a tool, the assembly being located in a borehole;

[0016] Fig. 2 shows an enlarged view of the connector of Fig. 1, the connector being in its locking position;

[0017] Fig. 3 shows the connector of Fig. 2 when the release object is weakened, thereby causing a spring to displace the locking object away from its locking position;

[0018] Fig. 4 shows the connector of Fig. 3 when the split connector ring is displaced away from its locking position, and the first connection part of the connector is being displaced away from the second connection part of the connector; and

[0019] Fig. 5 shows a smaller scale view of the connector in a released position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] In the figures reference numeral 1 denotes a connector that connects a pipe string 2 with a tool 4, all of which are placed in a borehole 5.

[0021] The connector 1 consists of a first connection part 6 which is fixedly attached to the pipe string 2, and which is of a design enabling it to be displaced into

a second connection part 8 in a releasable and locking manner. The second connection part 8 is fixedly attached to the tool 4.

[0022] The first connection part 6 is provided with a through-going bore 10, as shown in Fig. 2. The bore 10 is of a relatively large diameter extending from the lower end section of the first connection part 6 and onwards to a shoulder 14 located between the two end sections of the first connection part 6. The exterior of the first connection part 6 is provided with three encircling grooves 16 matching in a complementary manner an axially split locking ring 18.

[0023] Axially the locking ring 18 is positioned against a ledge 20 within the second connection part 8 and is held radially in its locking position by means of a locking sleeve 22 displaced inward and over the locking ring 18. The locking sleeve 22 is displaceably located within a bore 24 of the second connection part 8.

[0024] A spring 26 for displacing the locking sleeve 22 out of its locking position is placed between the locking sleeve 22 and the first connection part 6.

[0025] A first hydraulic pipe 28 running through the pipe string 2 is connected to a first coupling nipple 30. The first coupling nipple 30 is positioned against the shoulder 14 and is connected to a tubular release object 34 via threads 32. The releasable object 34 forms a portion of a hydraulic circuit.

[0026] A second hydraulic pipe 36 attached to the tool 4 is connected to a second coupling nipple 38. The second coupling nipple 38 is positioned against the end portion 40 of the locking sleeve 22 and is connected to the tubular release object 34 via threads 42.

[0027] The release object 34 together with the first coupling nipple 30 and the second coupling nipple 38 thereby prevent the locking sleeve 22 from being displaced out of its locking position.

[0028] Upon disengaging the tool 4 from the pipe string 2, acid is pumped down through the first hydraulic pipe 28 and down to the release object 34. Being of a

material that is relatively easy to dissolve, for example an aluminium alloy, the release object 34 is partially dissolved after being affected by acid for a period of time. Preferably the release object 34 is provided with a section 44 having reduced wall thickness. The coupling nipples 30, 38 are provided with seals 46 that prevent acid from flowing out of the bore 10 as the acid is pervasively corroding the release object 34.

[0029] Having consumed a transverse section of the release object 34, thereby dividing it into at least two parts, the spring 26 displaces the locking sleeve 22 axially and out of its locking position, as shown in Fig. 3.

[0030] Then the axially split locking ring 18 is displaced radially out of the grooves 16 in the first connection part 6 and outwards into the bore 24, as shown in Fig. 4. Thereby the first connection part 6 is released from the second connection part 8, and the connection parts 6, 8 then may be displaced axially and away from one another, as shown in Fig. 5.

[0031] It will be appreciated that variations in the above described embodiments may still fall within the scope of the invention, which is set out in the accompanying claims.